Oil Analysis of Army Aviation Systems

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Purpose of Briefing

- Provide results of AMRDEC Aviation Engineering Directorate (AED) airworthiness-based review of existing Army Oil Analysis Program (AOAP) - directed component teardown data.
- Identify current and potential benefits of oil analysis.
- Recommend a Path Forward reflecting coordinated position between AMCOM, AED, LOGSA AOAP Program Manager, and Program Executive Office - Aviation.

Conclusions
Oil Analysis Benefits

AOAP for Airworthiness:

- Based on a review by AED of the limited data available, oil analysis techniques used by AOAP has limited use as an airworthiness condition monitoring tool.
  - Primarily caused by a lack of correlation of AOAP oil analysis criteria to actual component condition as determined through component teardowns.
  - Data reviewed was based on limited teardown analysis from 7+ years ago. Components removed as a result of oil analysis recommendations have not been evaluated since that time.
  - Criteria currently used may result in unnecessary removal of components and unwarranted maintenance efforts.
- The available data is insufficient to conclude that no airworthiness (safety) issue will exist if oil analysis is terminated.
  - Requires a comprehensive review of all failure modes and effects for all components currently being monitored by AOAP.

Conclusions
Oil Analysis Benefits

AOAP for operational readiness and economy:

- Current oil analysis techniques used by AOAP are effective at determining lubricant physical properties and cleanliness.
  - Provides the basis for "on condition" oil changes when warranted and extends the life of components.
  - AMSAA verified UAH study conclusions that showed positive payback of ~$5M/yr when oil was sampled and moved to "on condition" from regular change intervals for Aviation Systems.
- Use of available oil analysis equipment and techniques in industry may provide a benefit to AOAP.
- Maintenance personnel from 160th SOAR participating in AOAP working group argued in support of continuing AOAP citing increased user confidence in safe operations and improved maintenance planning.

Recommended Path Forward

1. DETERMINE IF OIL ANALYSIS IS REQUIRED TO MAINTAIN AIRWORTHINESS OF AIRCRAFT SYSTEMS

1) AED to determine if oil analysis provides an airworthiness benefit.
   - Review failure modes and effects for all Aviation System oil-wetted components, hydraulic systems, and grease-lubricated components.
   - Based upon results of above, determine if oil analysis is required to identify an impending failure of one of the above components.
   - Revise oil analysis criteria used by AOAP to insure removals are warranted from an airworthiness perspective.
   - Estimate one-year effort to address all Army Aviation Systems.
2) Immediately stop issuing recommendations for component removals without AED concurrence.
   - All AOAP lab recommendations directing removal of components shall require review and coordination from AED prior to transmittal to field units.
   - Allows AED to apply available analysis results and lessons learned to recommendation development process.
   - Provides an immediate reduction in premature/false removals and will provide data needed support the failure modes and effects review effort.

Recommended Path Forward

2. REVISE AOAP CRITERIA AND GUIDELINES TO MAXIMIZE THE BENEFIT TO OPERATIONAL READINESS AND ECONOMY OF OPERATION FOR AIRCRAFT SYSTEMS

Establish a Collaborative Alliance between AMCOM; Aviation Engineering Directorate; PEO Aviation; the Program Manager, AOAP; and the Field user.

- Conduct studies to quantify benefits of oil analysis in terms of operational readiness and economy of operation.
- Survey other services and FMS users on their oil analysis practices and experience.
- Survey industry on advances in chip detection, particle counting technology and debris monitoring.
- Provide communication channels to identify issues and to coordinate efforts.
- Determine optimal sampling intervals.
- Revise oil analysis criteria used by AOAP to insure removals are warranted from an operational readiness, safety and economy of operation perspective.
- Jointly execute the overhaul/restructure of AOAP and revise AOAP/JOAP Regulations and Doctrine applicable to the Aviation Community.
- Modeled after successful AOAP/TACOM Collaborative Alliance.

Time Line

1st Qtr:

- AED commence review of failure modes and effects for all applicable components.
- Establish Collaborative Alliance With AMCOM, AED PEO AVN and LOGSA.
- AOAP direct Field Labs to coordinate recommendations with AED.
- Conduct Joint Oil Analysis Program CG/EG meeting with other services.

2nd – 3rd Qtr:

- AED continue review of failure modes and effects for all applicable components.
- Host aeronautical world-wide conference with members of the Collaborative alliance, the Army Safety Center and MACOMS aeronautical reps.

4th Qtr:

- Finalize system enrollments and/or removals, sampling interval determinations, and AOAP lab analysis criteria.
- Update all applicable aeronautical regulations.